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OCEANOGRAPHY FOR SUBMARINE LONG RANGE SONAR IN ATLANTIC AREA J --ETC(U)
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1 OF 1
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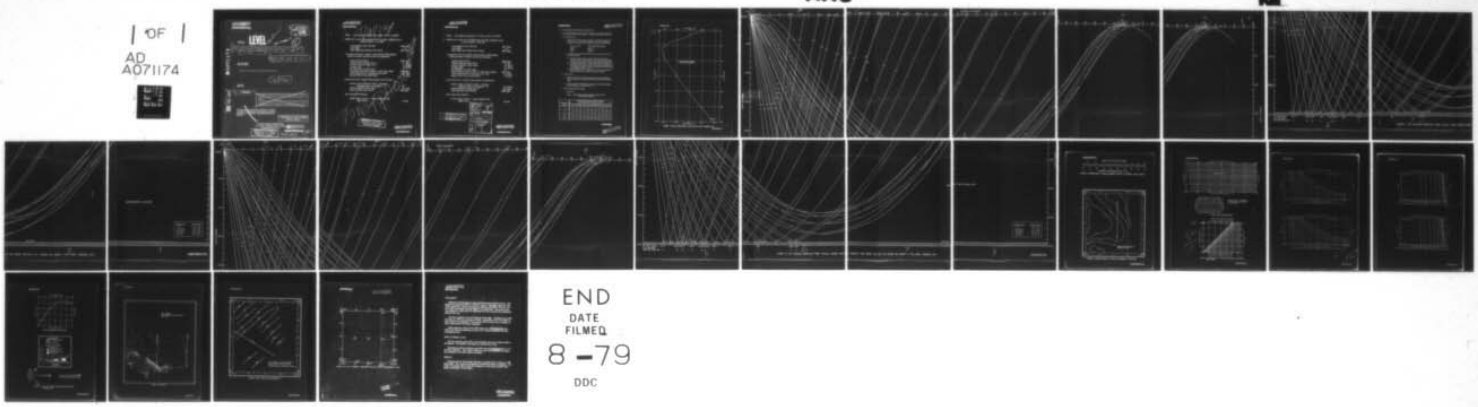

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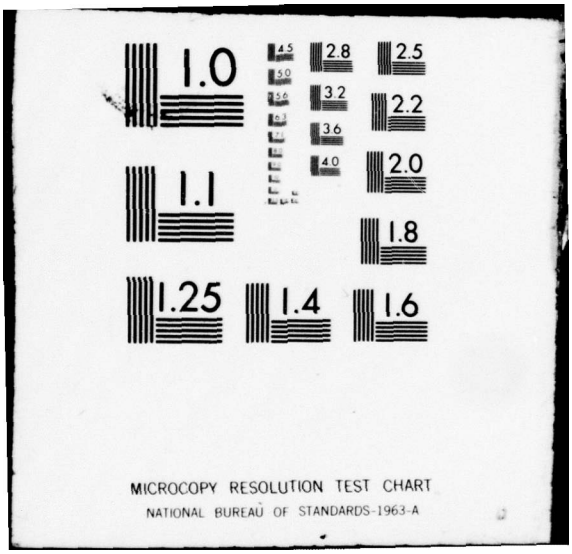
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1.4
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4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

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(9) INFORMAL MANUSCRIPT REPORT, NO. 0-111-63

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TITLE **LEVEL II** Good

MOST Project-2

(15) 35

(6) OCEANOGRAPHY FOR SUBMARINE LONG RANGE SONAR IN ATLANTIC AREA J FOR APRIL THROUGH JULY.

(14) NOO-IM-0-111-63

AUTHOR

OCEANOGRAPHIC DEVELOPMENT DIVISION

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MARINE SCIENCES DEPARTMENT
U. S. NAVAL OCEANOGRAPHIC OFFICE
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I AREA: One-degree quadrangle 22° to 23°N, 69°45' to 70°45'W

II PREDICTED VALUES FOR QUADRANGLE FOR APRIL THROUGH JULY
(SOURCE DEPTH = 150 FEET)

Sound Speed at Sonar (150 feet)	5046 ft/sec
Layer Depth	0 ft
Layer Depth Sound Speed (at the surface)	5051 ft/sec

Convergence Zone (For a depth of approximately 3,000 fathoms, surface and bottom reflected rays are not considered)

Speed at Bottom (Fig 4)	5098 ft/sec
Minimum Refracted Angle (Fig 6)	+1° (up)
Maximum Refracted Angle (Fig 6)	-7° (down)
Average Angle	-3° (down)
Best Equipment Tilt (D/E) Angle	0°
Mean Horizontal Speed for Best Tilt (D/E) Angle (Fig 8)	4921 ft/sec
Initial Range (Fig 7) at the Surface (-5° down)	70.7 kyds
Reswept Surface Zone Width (Fig 2)	0.7 kyds

Bottom Bounce (For a depth of approximately 3,000 fathoms)

Minimum Useful Inclination Angle = Maximum Refracted Angle of Convergence +3° =	10°
Predicted Detection Range (Fig 7)	53.5 kyds
Mean Horizontal Speed (Fig 8)	4925 ft/sec

Near Surface Path Detection

12-knot Figure of Merit + Target Strength 215 db Range (Table 1)	8 kyds

I AREA: One-degree quadrangle 22° to 23°N, 69°45' to 70°45'W

II PREDICTED VALUES FOR QUADRANGLE FOR APRIL THROUGH JULY
(SOURCE DEPTH = 250 FEET)

Sound Speed at Sonar (250 feet)	5041 ft/sec
Layer Depth	0 ft
Layer Depth Sound Speed (at the surface)	5051 ft/sec

Convergence Zone (For a depth of approximately 3,000 fathoms, surface and bottom reflected rays are not considered)

Speed at Bottom (Fig 4)	5098 ft/sec
Minimum Refracted Angle (Fig 6)	+3° (up)
Maximum Refracted Angle (Fig 6)	-7° (down)
Average Angle	-2° (down)
Best Equipment Tilt (D/E) Angle	0°
Mean Horizontal Speed for Best Tilt (D/E) Angle (Fig 8a)	4919 ft/sec
Initial Range (Fig 7a) at the Surface (-5° down)	70.4 kyds
Reswept Surface Zone Width (Fig 2a)	0.5 kyds

Bottom Bounce (For a depth of approximately 3,000 fathoms)

Minimum Useful Inclination Angle = Maximum Refracted Angle of Convergence +3° =	-10° (down)
Predicted Detection Range (Fig 7a)	55.3 kyds
Mean Horizontal Speed (Fig 8a)	4865 ft/sec

Near Surface Path Detection

12-knot Figure of Merit + Target Strength 215 db Range (Table 1)	8 kyds

III USE OF GRAPHS FOR PARTICULAR CONDITIONS

1. From BT temperature trace, determine and tabulate sound speed at sonar depth (V_1) and at layer depth (V_2) from Figure 5. Tabulate bottom (V_3) from Figure 4.

2. Convergence zone

   a. Determine if convergence zone is possible. The difference between the bottom speed (V_3) and speed at sonar depth (V_1) will give a qualitative indication of convergence zone existence according to the table below.

$V_3 - V_1$ (ft/sec)	Convergence Zone Existence
Negative	None
0-30	Borderline
>30	Strong

   b. To determine angular width and midpoint of totally refracted rays usable in convergence zone:

      (1) Determine minimum angle for totally refracted ray from Figure 6 using sound speed at sonar depth (V_1) and sound speed at layer depth (V_2) (first vertexing speed). With no layer, the minimum angle is 0°.
      (2) Determine maximum angle for totally refracted ray from Figure 6 using sound speed at sonar depth and bottom sound speed (V_3) (second vertexing speed) from Figure 4. (Bottom sound speed may also be obtained from sound speed profile in Figure 1).
      (3) Best tilt (D/E) angle for convergence zone will be that equipment tilt nearest the average of the minimum and maximum angles.

3. Bottom Bounce

   a. Refracted ray angle (to the nearest degree) tangent to the bottom [Item 2 b (2), above] plus 3° determines the minimum useful bottom bounce Ray angle.

   b. Use the equipment tilt (D/E) angle nearest to the minimum useful bottom bounce Ray angle as computed in Item III 3 a.

4. Near surface path detection range

   a. Use Table 1.

TABLE 1 MEAN SURFACE PATH DETECTION RANGE (KYDS) OF A SHALLOW TARGET

LAYER DEPTH (FEET)	FIGURE OF MERIT PLUS TARGET STRENGTH (ALLOWABLE TWO-WAY LOSS IN DB)										
	170	175	180	185	190	195	200	205	210	215	220
0	3	3	4	4	5	5	6	7	8	8	9
50	7	8	10	11	12	14	15	17	19	20	22
100	10	11	13	16	17	19	22	24	26	29	31
400	13	17	19	23	27	30	34	38	41	45	49

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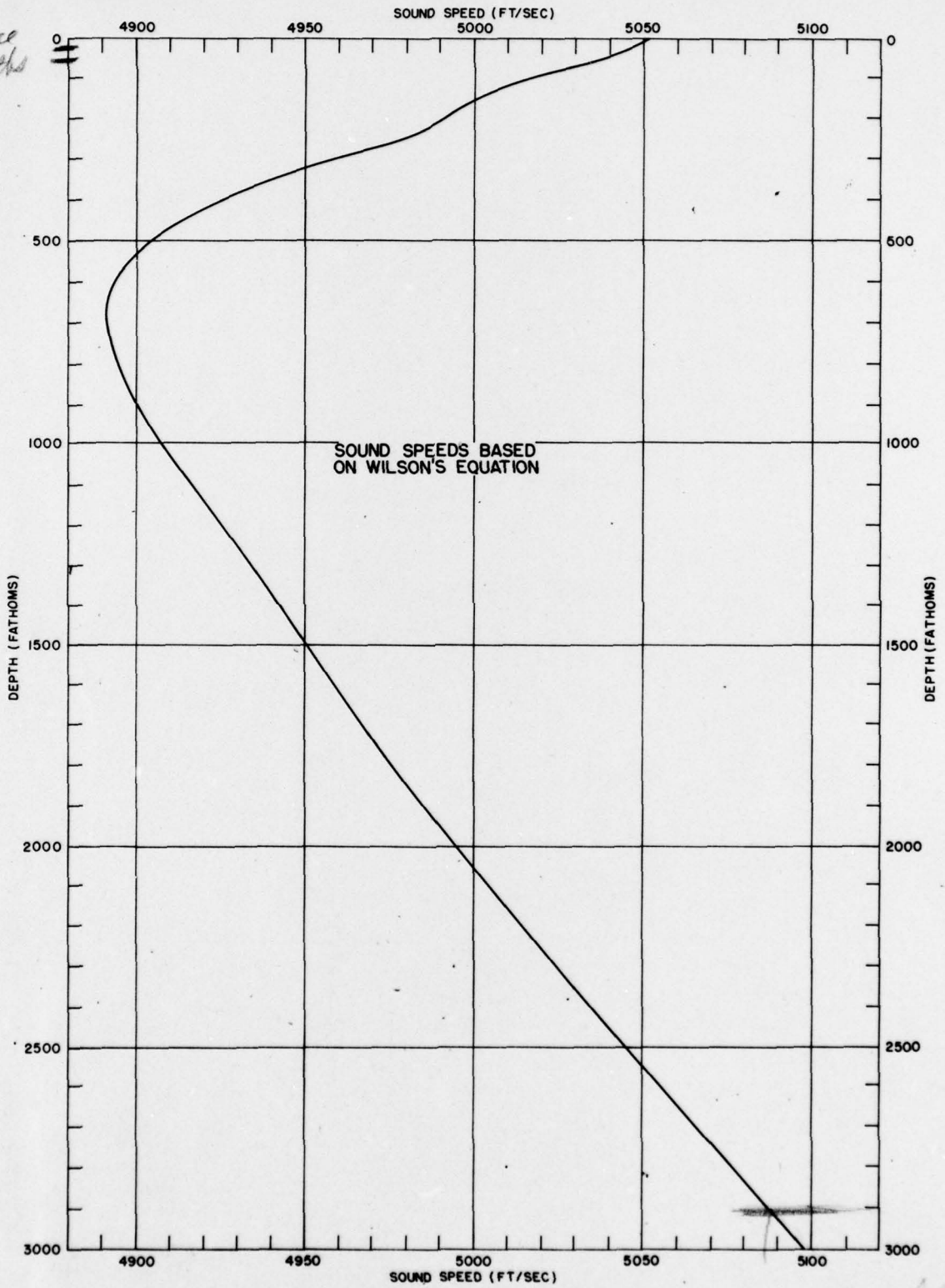

FIGURE 1 TYPICAL SOUND SPEED PROFILE FOR APRIL THROUGH JULY

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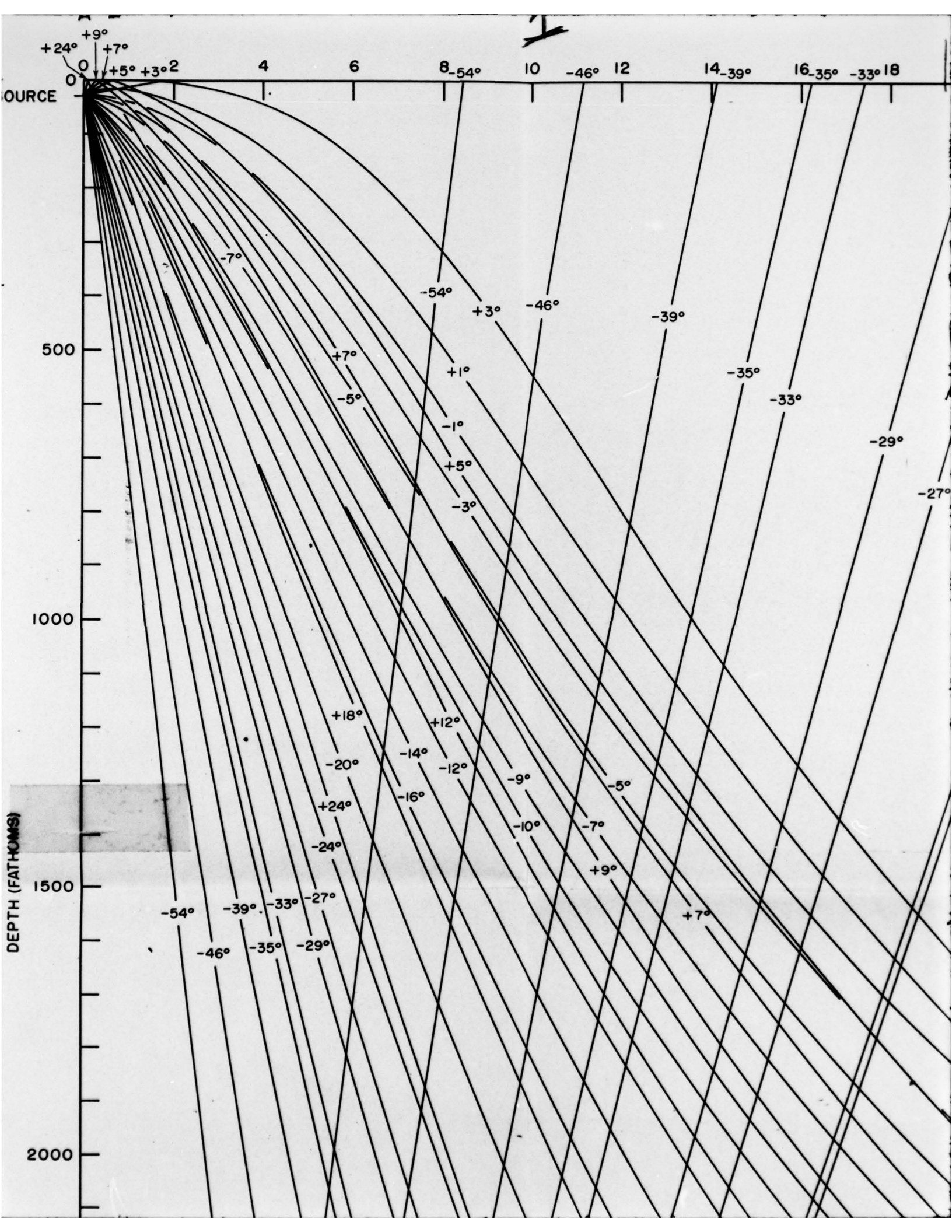
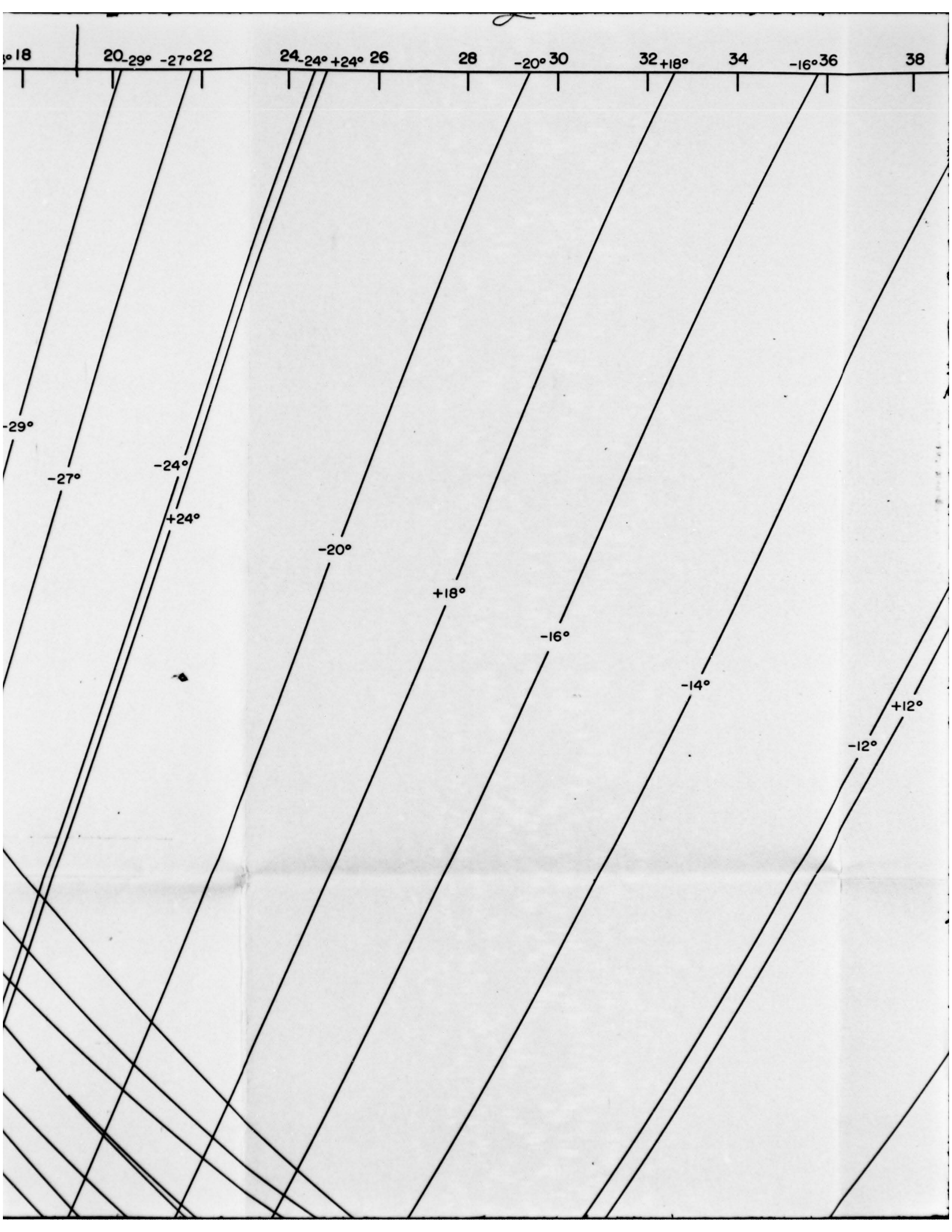

SOURCE
0
2
4
6
8
10
12
14
16
18
+24°
+9°
+7°
0
+5°
+3°
-54°
-46°
-39°
-35°
-33°
-7°
-54°
+3°
-46°
-39°
+7°
+1°
-35°
-5°
-33°
-1°
-29°
+5°
-27°
-3°
+18°
+12°
-14°
-20°
-12°
-9°
-5°
-16°
+24°
-10°
-7°
-24°
+9°
-54°
-39°
-33°
-27°
+7°
-46°
-35°
-29°
500
1000
1500
2000
DEPTH (FATHOMS)


18
20
-29°
-27°
22
24
-24°
+24°
26
28
-20°
30
32
+18°
34
-16°
36
38
-29°
-27°
-24°
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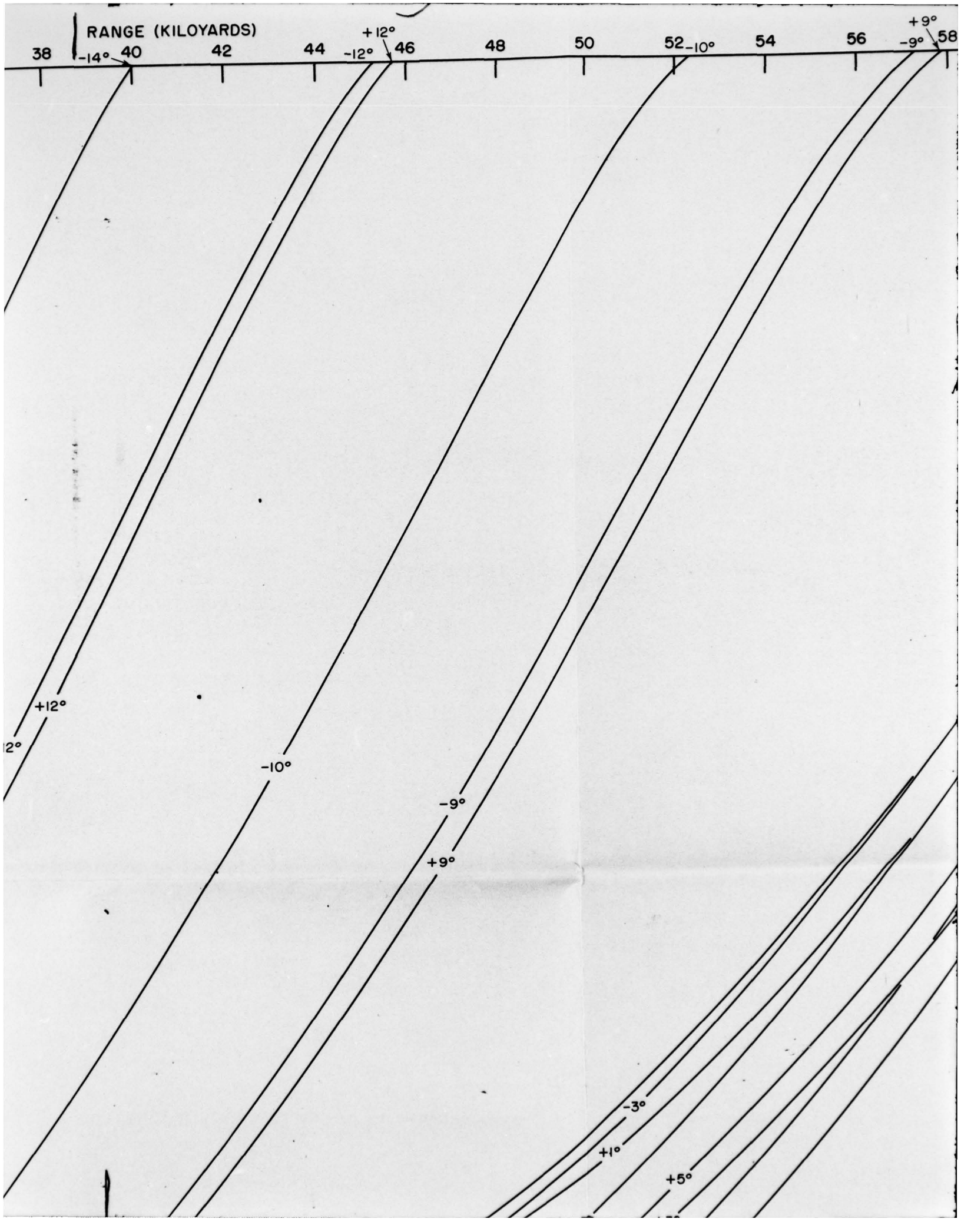
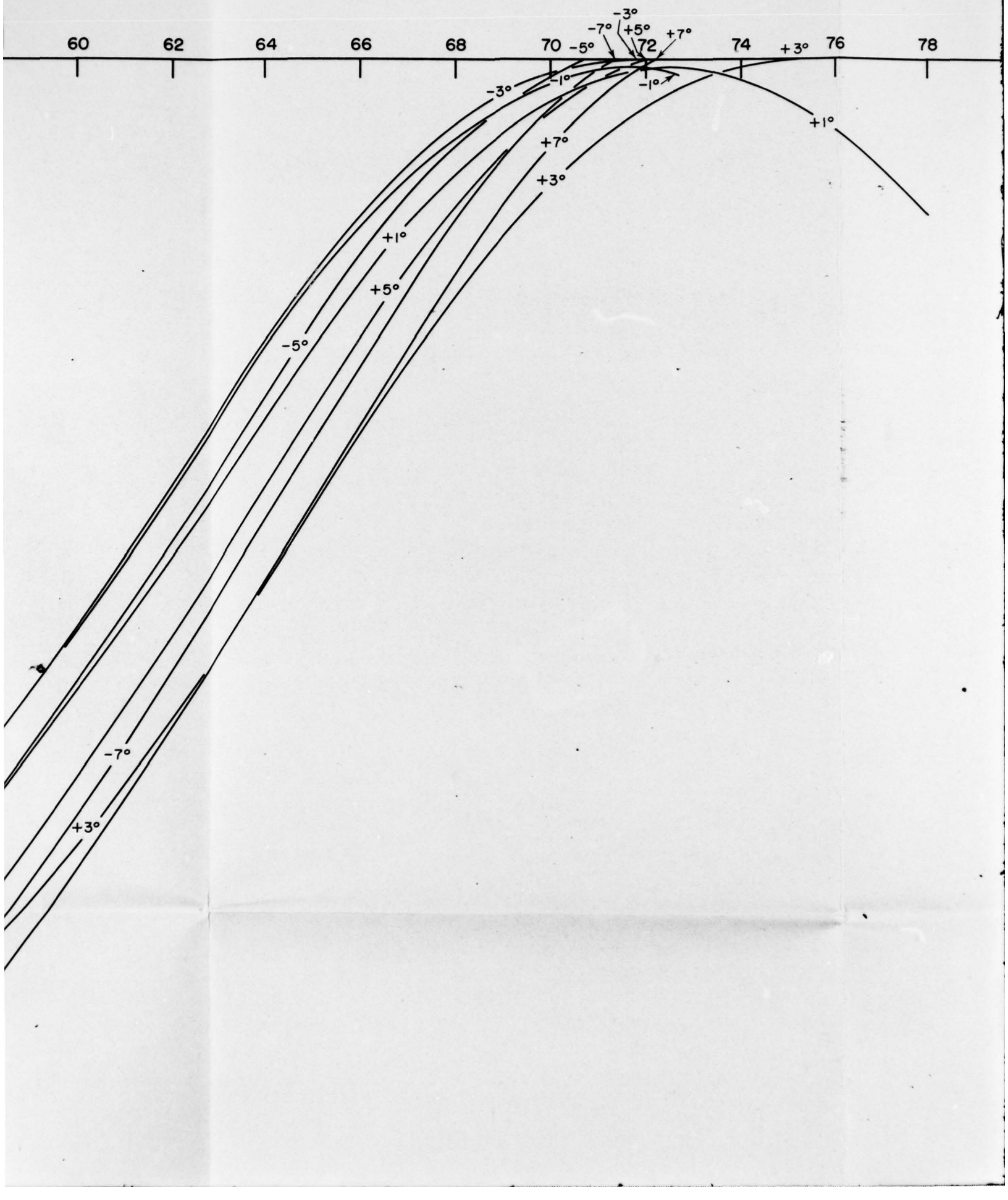
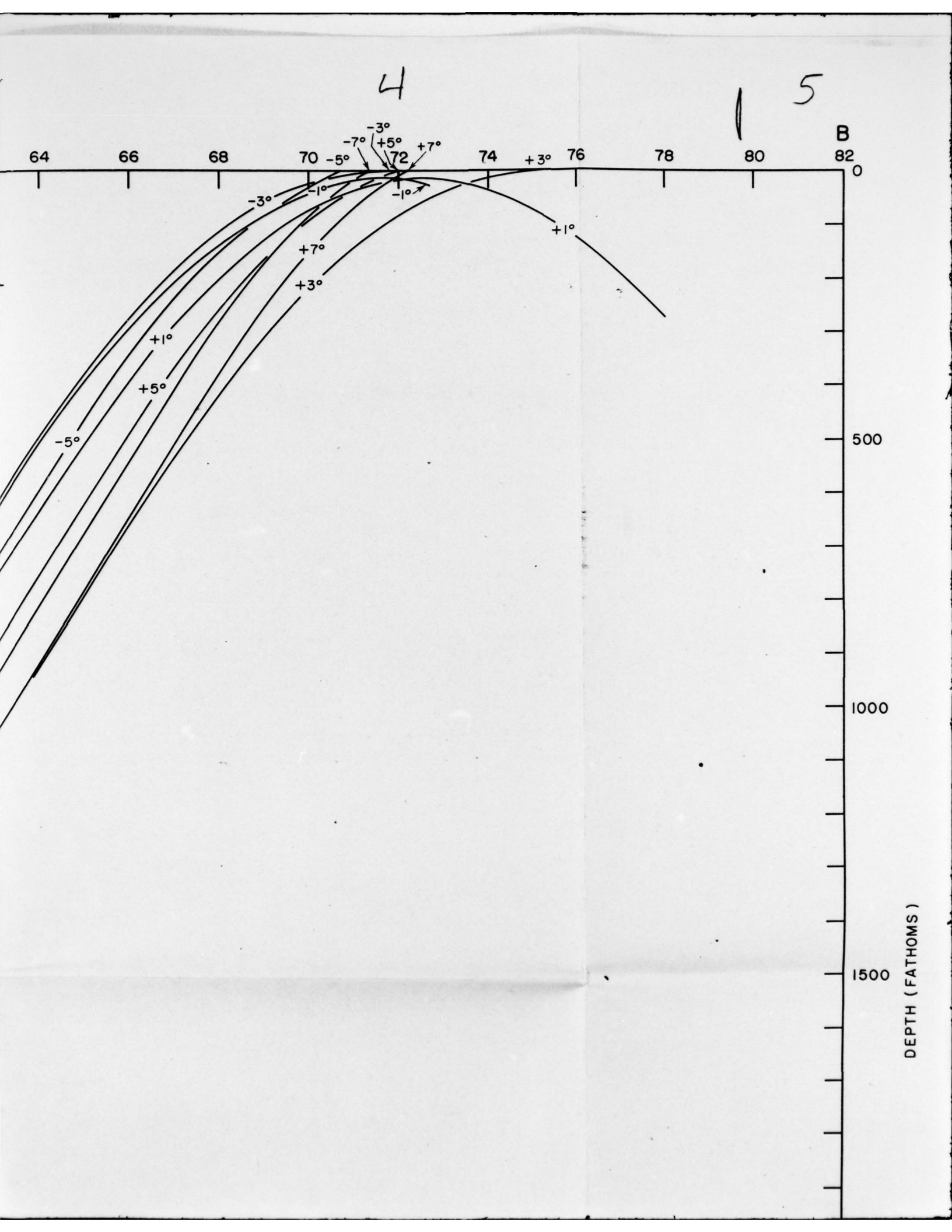
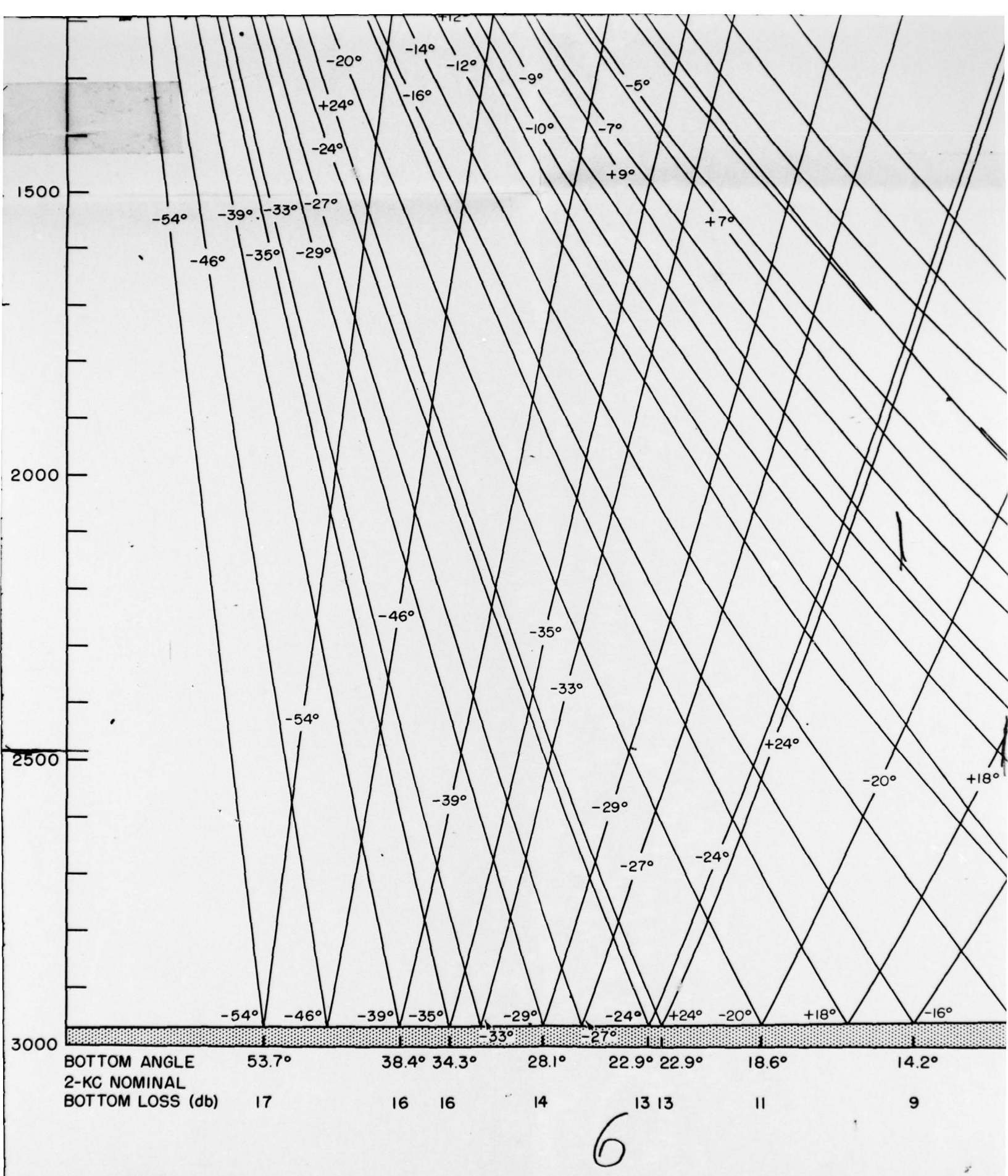
-20°
+18°
-16°
-14°
+12°
-12°


RANGE (KILOYARDS)
38
40
42
44
46
48
50
52
54
56
58
-14°
+12°
-12°
-10°
+9°
-9°
+12°
-10°
-9°
+9°
-3°
+1°
+5°


60
62
64
66
68
70
72
74
76
78
-3°
-7°
+5°
+7°
-5°
+3°
-3°
-1°
-1°
+1°
+7°
+3°
+1°
+5°
-5°
-7°
+3°


4
1 5
B
64
66
68
70
72
74
76
78
80
82
0
500
1000
1500
DEPTH (FATHOMS)
-3°
-7°
+5°
+7°
-5°
+3°
-1°
-1°
-3°
+1°
+7°
+3°
+1°
+5°
-5°


1500
2000
2500
3000
-54°
-39°
-33°
-27°
-46°
-35°
-29°
-20°
-14°
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-9°
-5°
-16°
+24°
-10°
-7°
-24°
+9°
+7°
-46°
-35°
-33°
-54°
-39°
-29°
-27°
-24°
+24°
-20°
+18°
-54°
-46°
-39°
-35°
-29°
-24°
+24°
-20°
+18°
-16°
-33°
-27°
BOTTOM ANGLE
53.7°
38.4°
34.3°
28.1°
22.9°
22.9°
18.6°
14.2°
2-KC NOMINAL
BOTTOM LOSS (db)
17
16
16
14
13
13
11
9

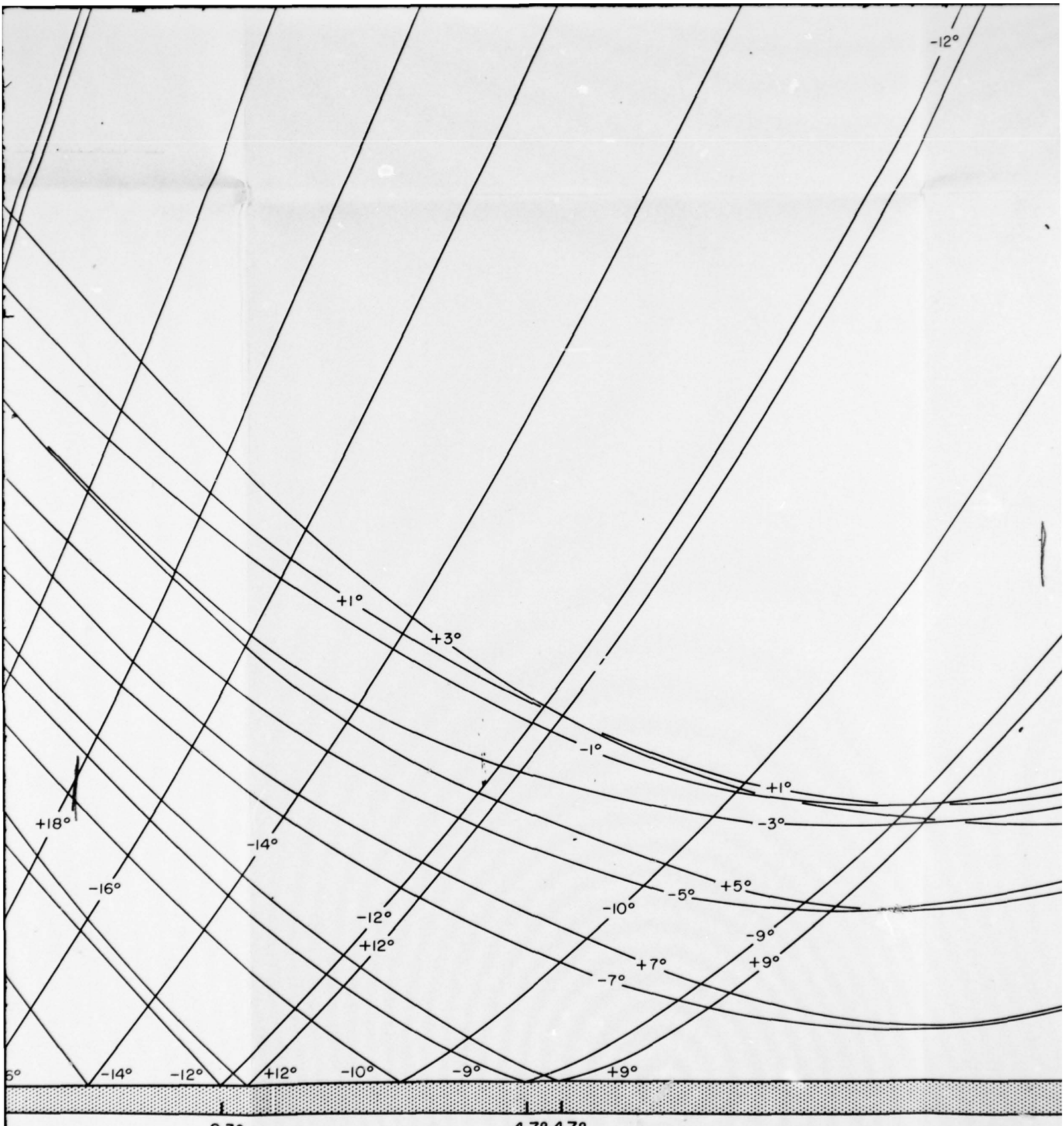
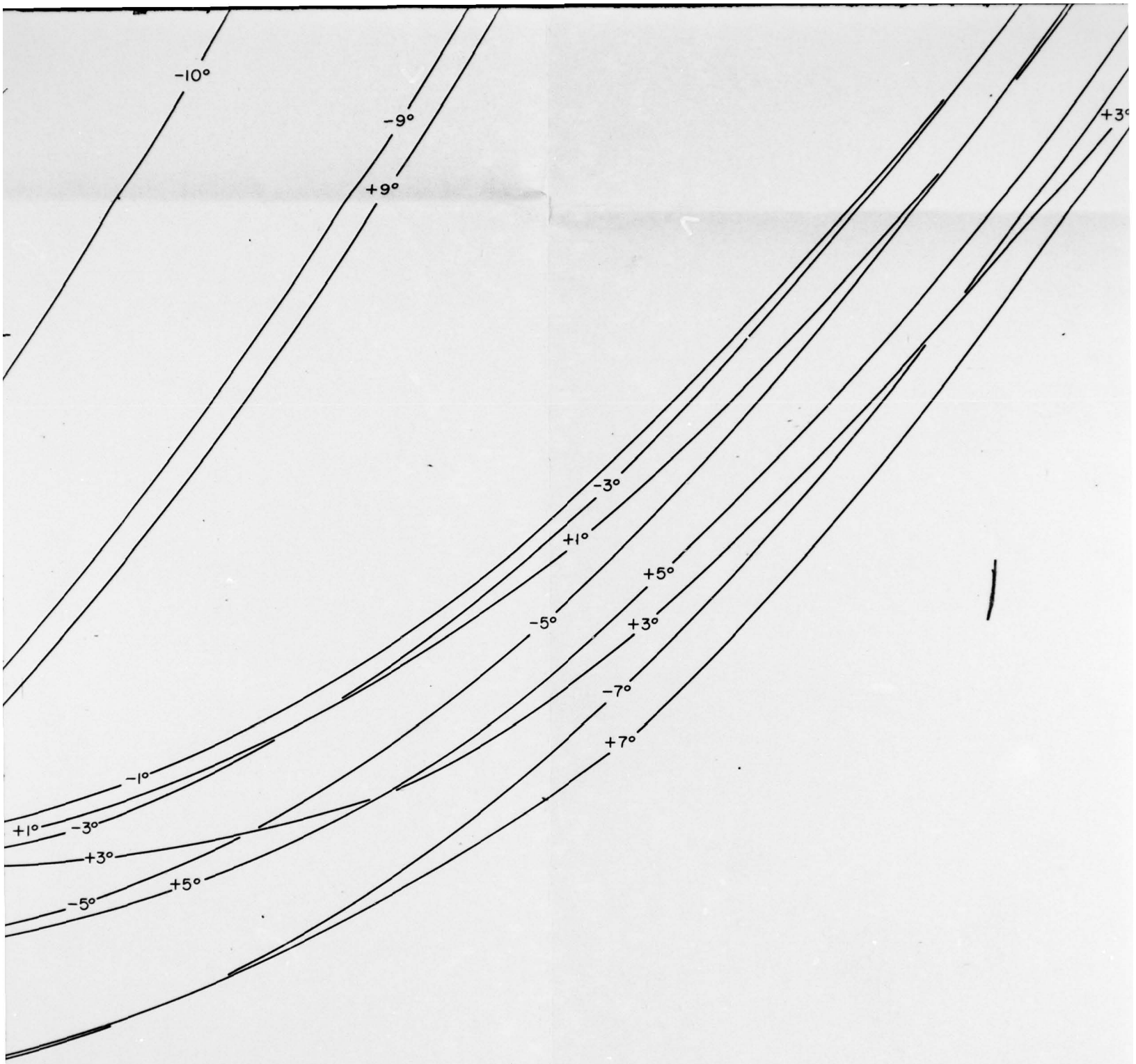


FIGURE 2 RAY DIAGRAM COMPUTED FROM TYPICAL SOUND SPEED PRO

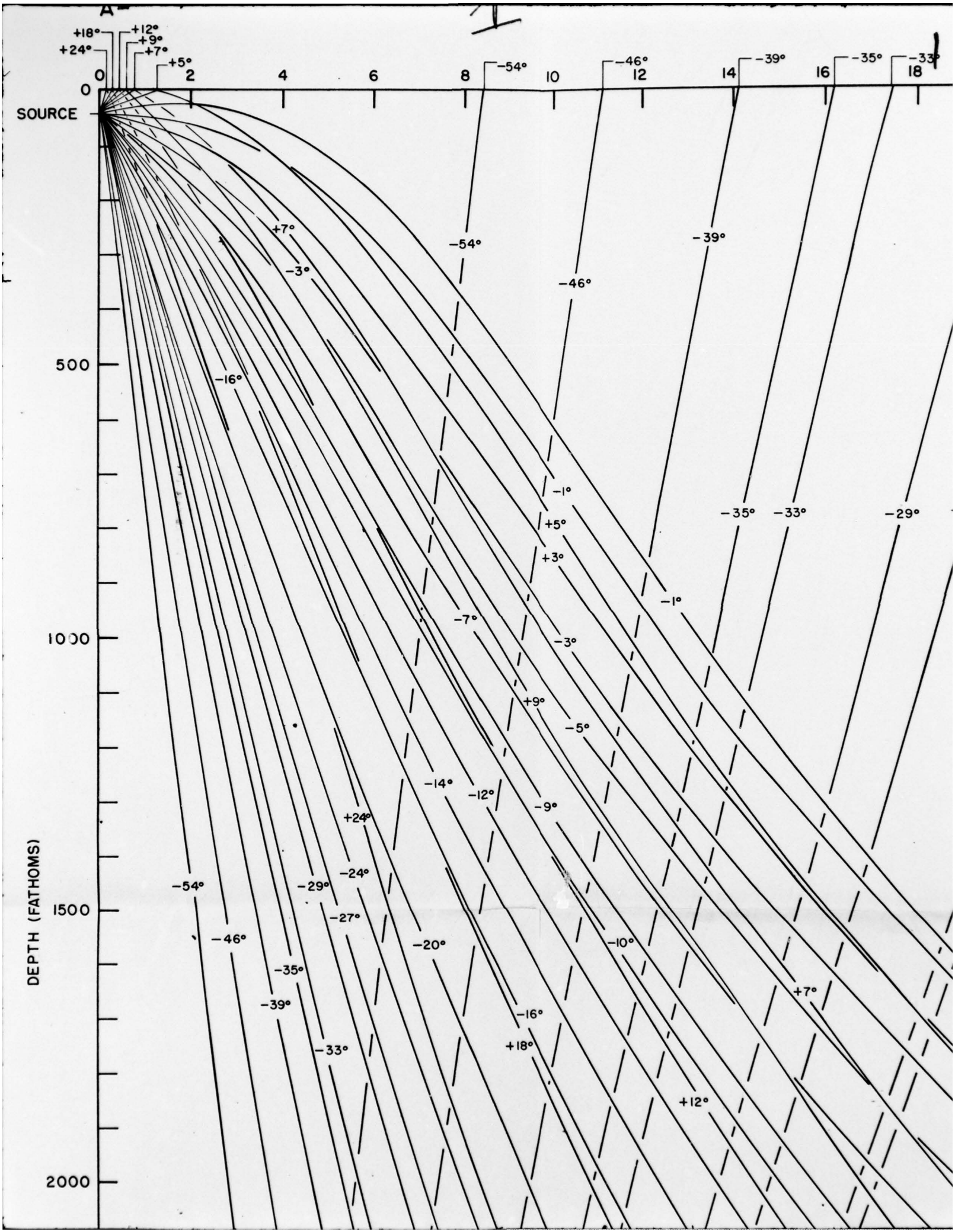


8

ILE FOR CROSS SECTION A-B SHOWN ON FIGURE 4 FOR APRIL THROUGH JULY

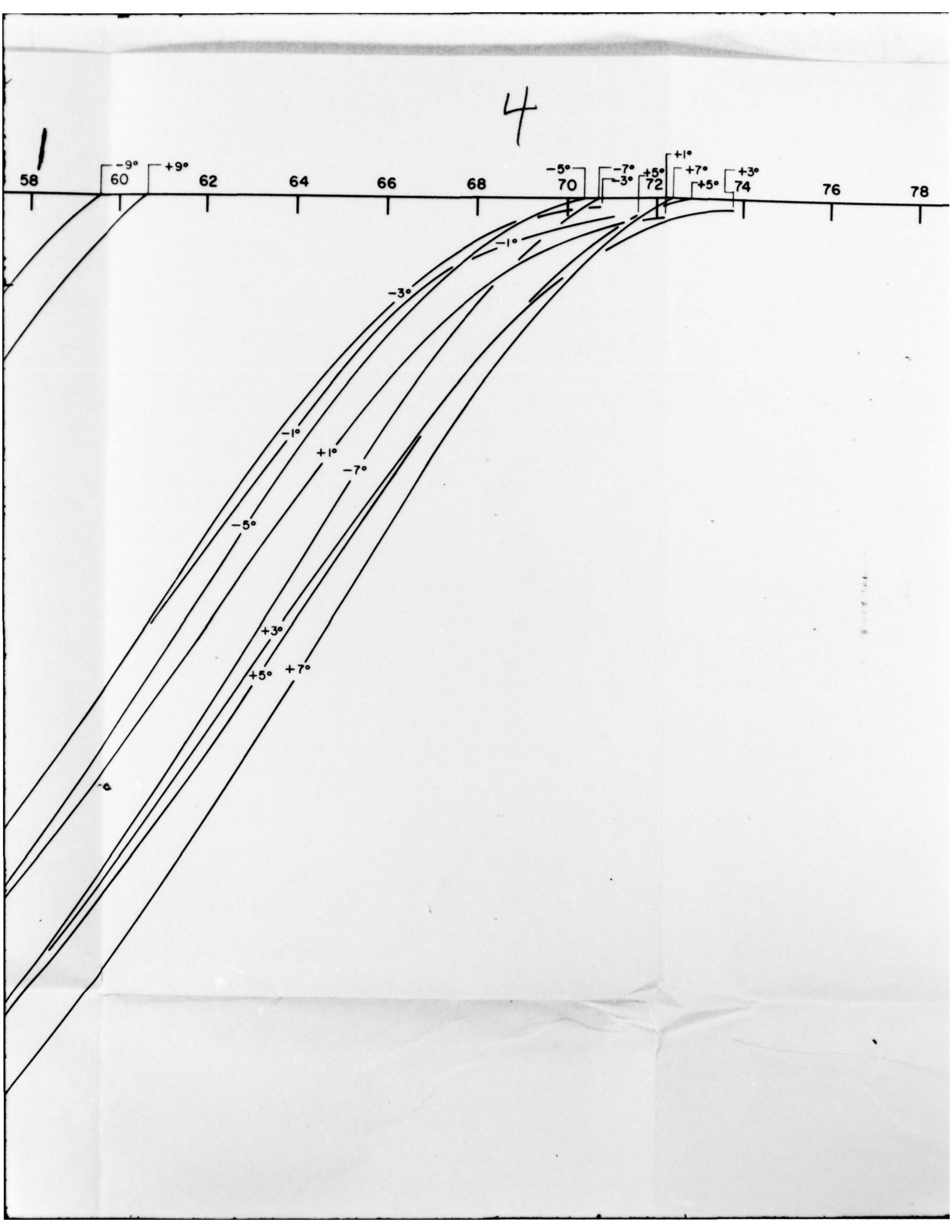
SOURCE DEPTH = 150 FEET

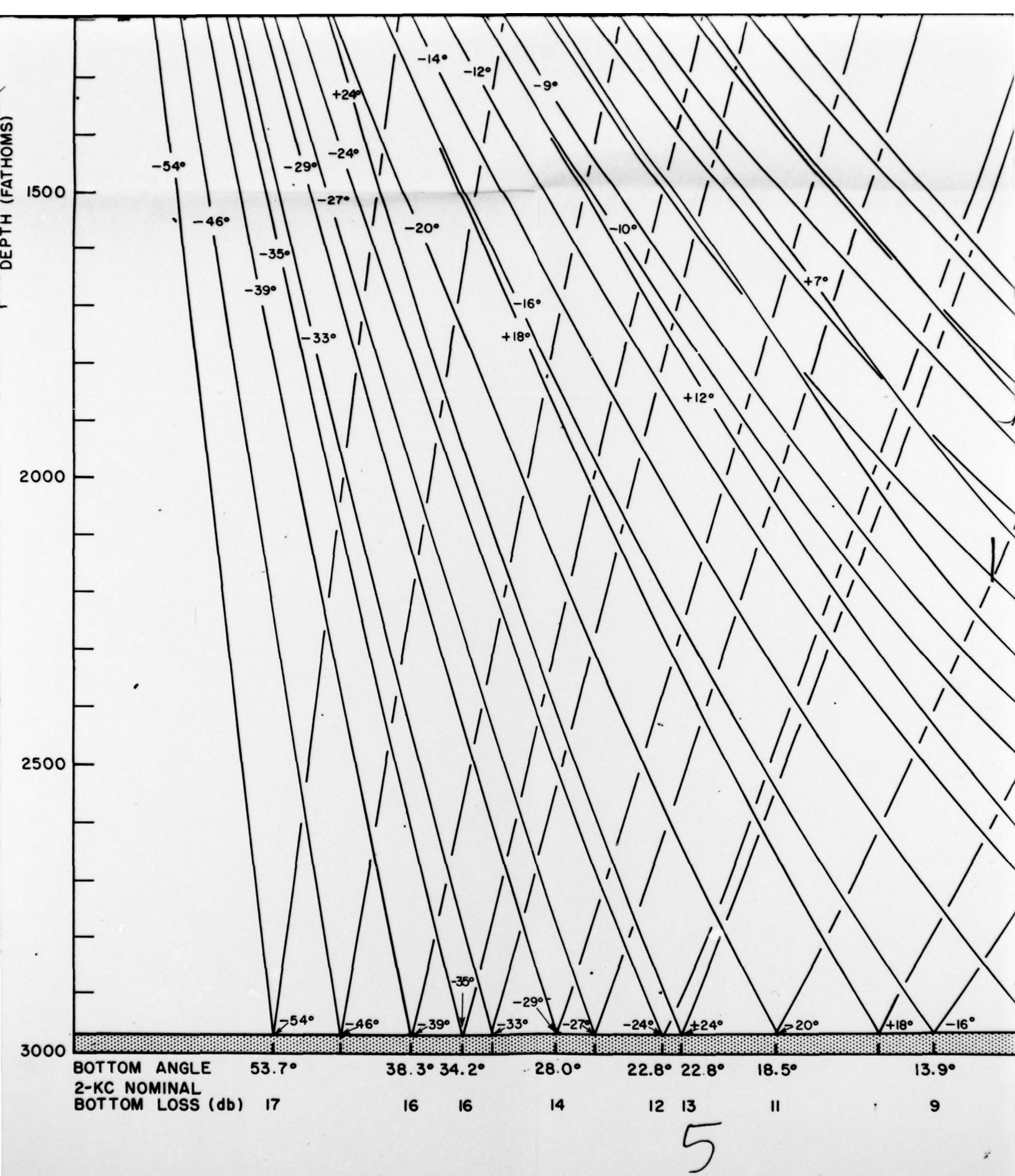
Equipment Tilt	Rays Included
0°	+ 9° to - 9°
-15° (Down)	- 6° to -24°
-30° (Down)	-21° to -39°
-45° (Down)	-36° to -54°
+15° (Up)	+ 6° to +24°


SOURCE
DEPTH (FATHOMS)
0
500
1000
1500
2000
0
2
4
6
8
10
12
14
16
18
+18°
+12°
+9°
+24°
+7°
+5°
-54°
-46°
-39°
-35°
-33°
+7°
-3°
-16°
-1°
+5°
+3°
-7°
-3°
-5°
+9°
-14°
-12°
-9°
+24°
-54°
-29°
-24°
-27°
-46°
-20°
-10°
-35°
-39°
-16°
+7°
-33°
+18°
+12°
-29°


-35°
-33°
18
20
-29°
-27°
22
-24°
24
+24°
26
28
-20°
30
32
+18°
34
-16°
36
-29°
-27°
-24°
+24°
-20°
+18°
-16°
-14°


RANGE (KILOYARDS)
38
40
42
44
46
48
50
52
54
56
-14°
-12°
+12°
-10°
-12°
+12°
-10°
-9°
+9°
+1°
+3°
+7°


4
1
58
60
62
64
66
68
70
72
74
76
78
-9°
+9°
-5°
-7°
-3°
+5°
+1°
+7°
+3°
+5°
-1°
-3°
-1°
+1°
-7°
-5°
+3°
+5°
+7°


DEPTH (FATHOMS)
1500
2000
2500
3000
-54°
-46°
-39°
-35°
-33°
-29°
-27°
-24°
+24°
-20°
-16°
+18°
-14°
-12°
-9°
-10°
+12°
+7°
-54°
-46°
-39°
-35°
-33°
-29°
-27°
-24°
+24°
-20°
+18°
-16°
BOTTOM ANGLE 53.7° 38.3° 34.2° 28.0° 22.8° 22.8° 18.5° 13.9°
2-KC NOMINAL
BOTTOM LOSS (db) 17 16 16 14 12 13 11 9

5

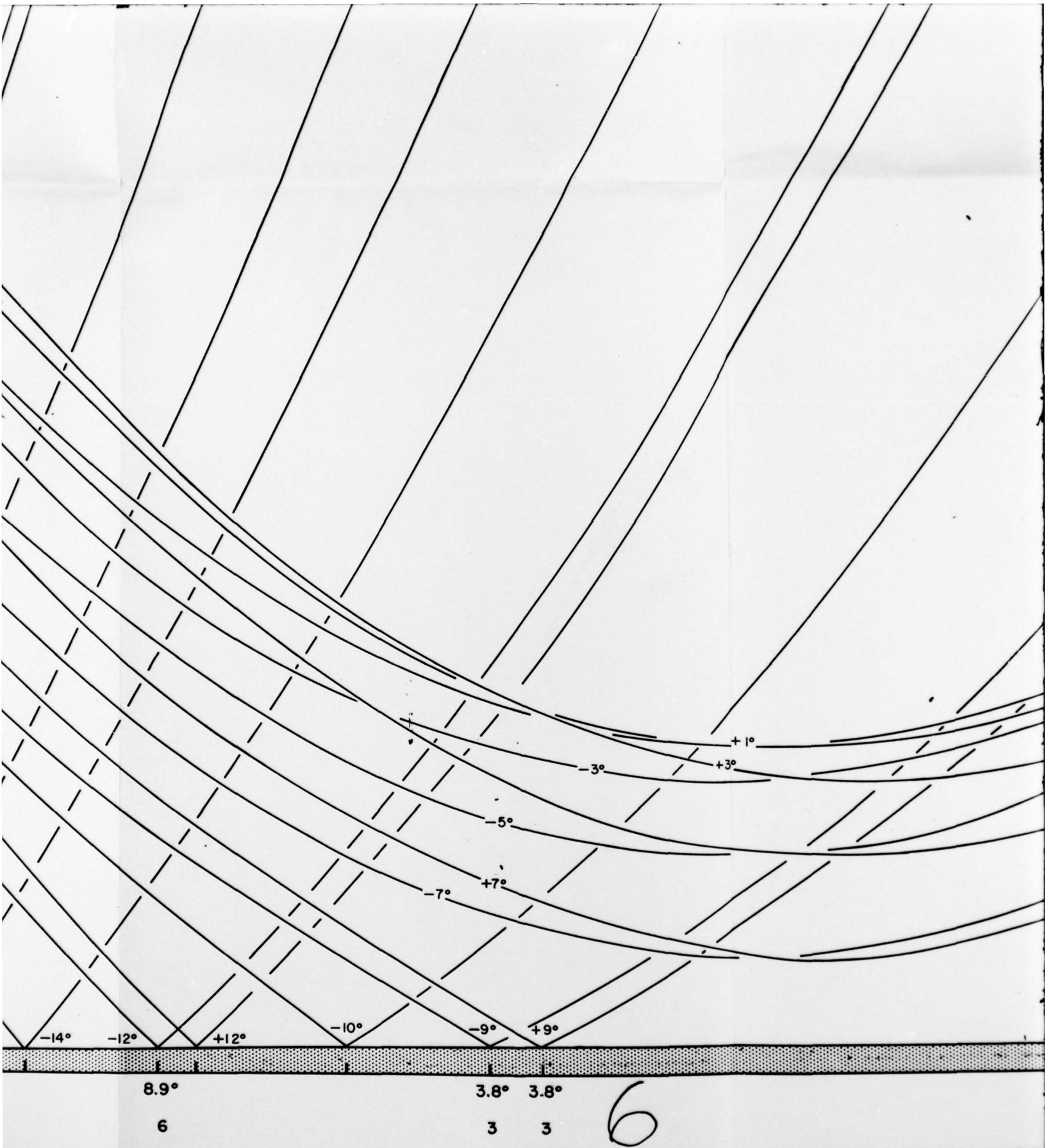
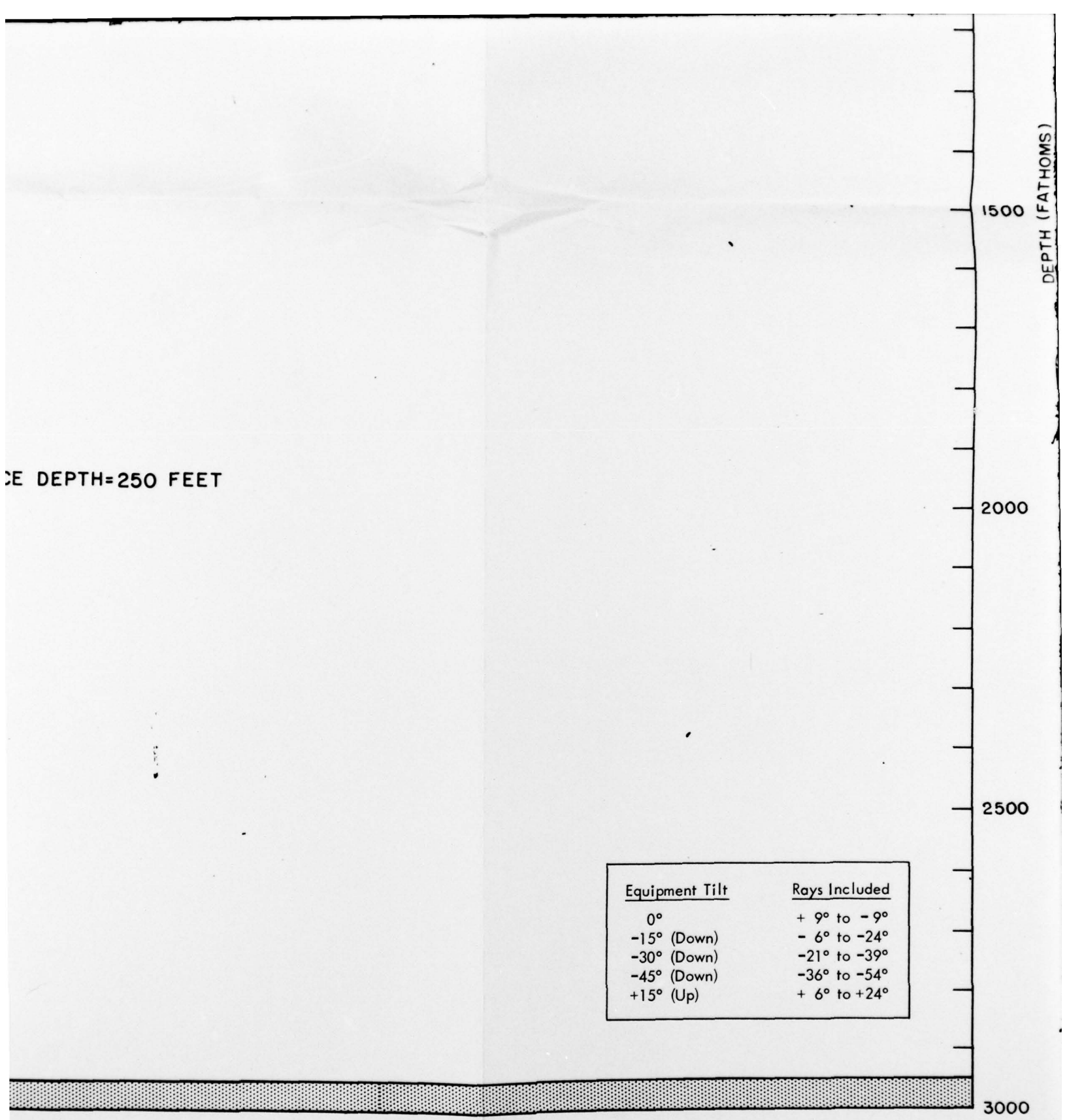


FIGURE 2a RAY DIAGRAM COMPUTED FROM TYPICAL SOUND SPEE

) PROFILE FOR CROSS SECTION A-B SHOWN ON FIGURE 4 FOR APRIL THROUGH JULY

CE DEPTH=250 FEET



Equipment Tilt	Rays Included
0°	+ 9° to - 9°
-15° (Down)	- 6° to -24°
-30° (Down)	-21° to -39°
-45° (Down)	-36° to -54°
+15° (Up)	+ 6° to +24°

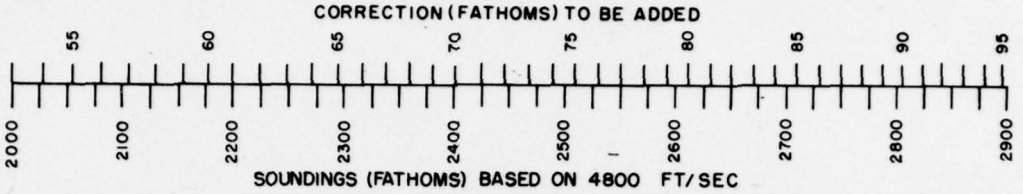


FIGURE 3 CORRECTION TO ECHO-SOUNDER DEPTH TO OBTAIN TRUE DEPTH

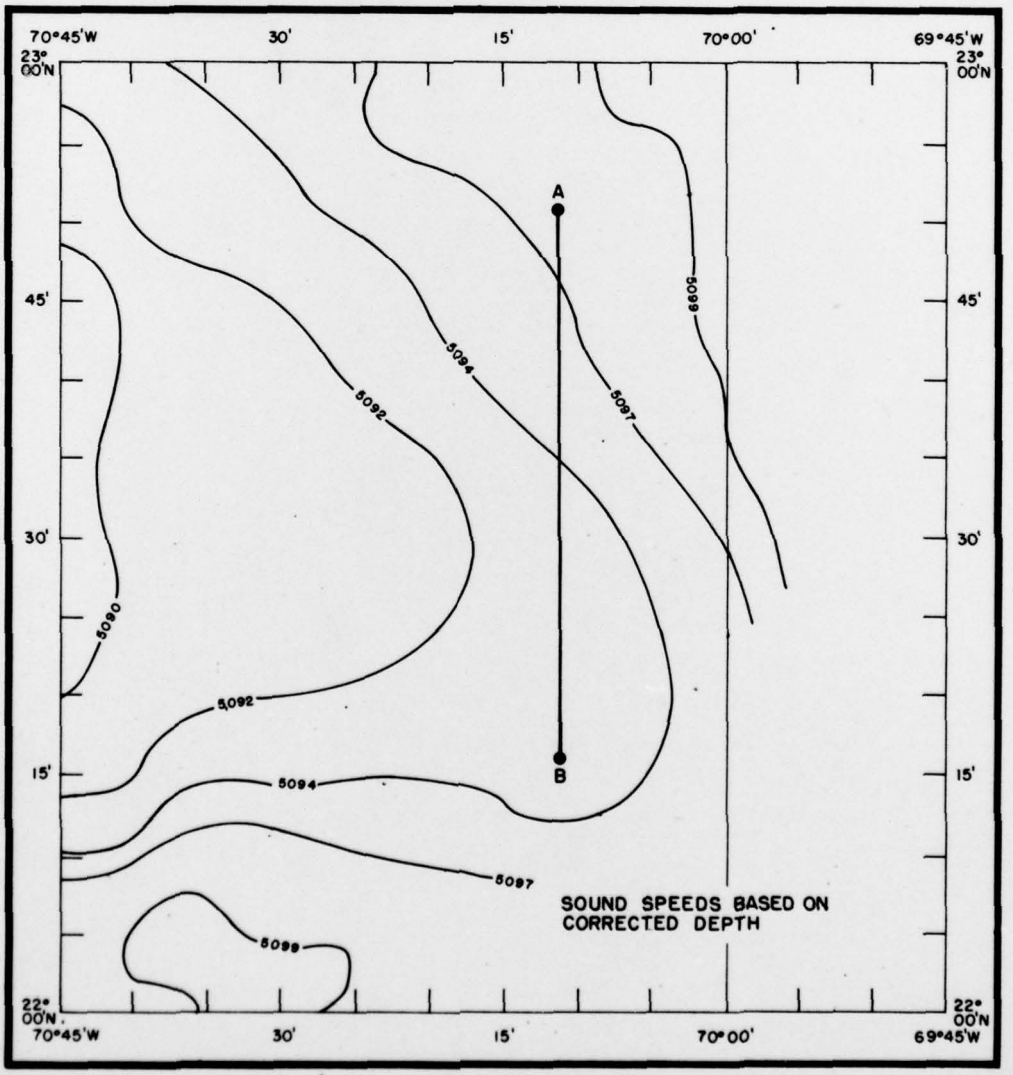
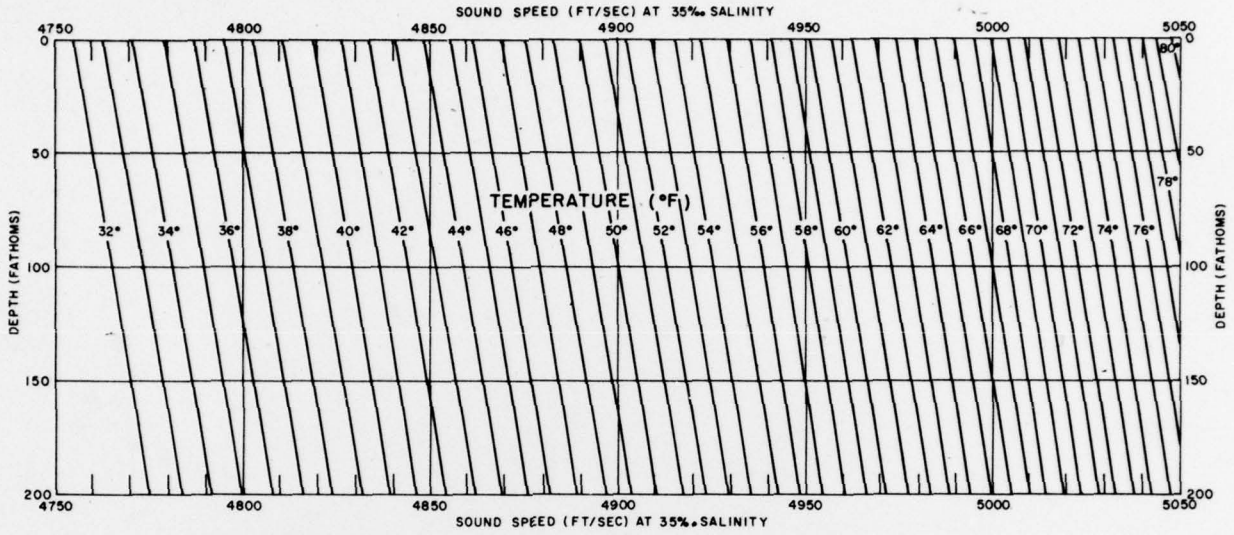
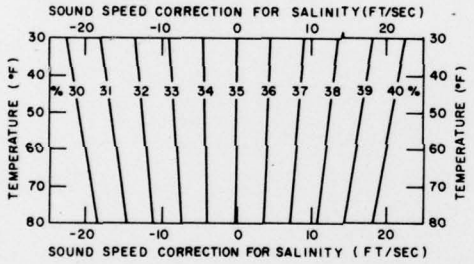


FIGURE 4 SOUND SPEED (FT/SEC) IN WATER AT BOTTOM

AREA J





NORMAL SALINITY CORRECTION FOR THIS AREA AND SEASON IS + 4 FT/SEC

FIGURE 5 SOUND SPEED NOMOGRAM

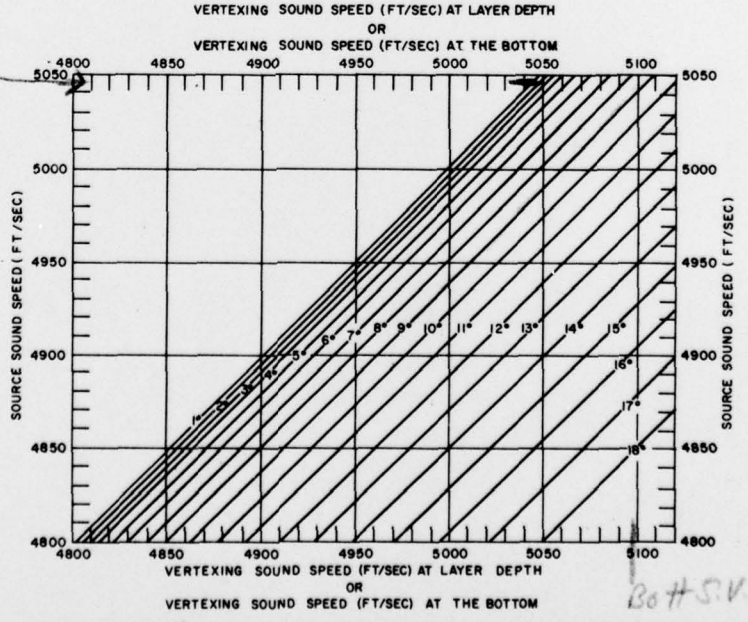


FIGURE 6 INCLINATION ANGLE VS SOURCE SOUND SPEED AND VERTEXING SOUND SPEED

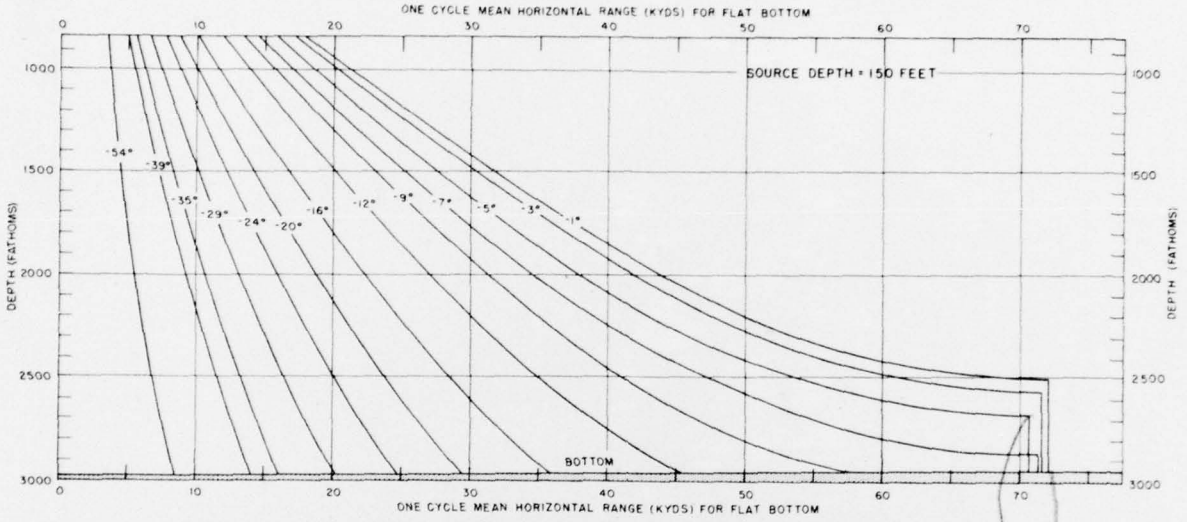


FIGURE 7 MEAN HORIZONTAL RANGE VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR APRIL THROUGH JULY

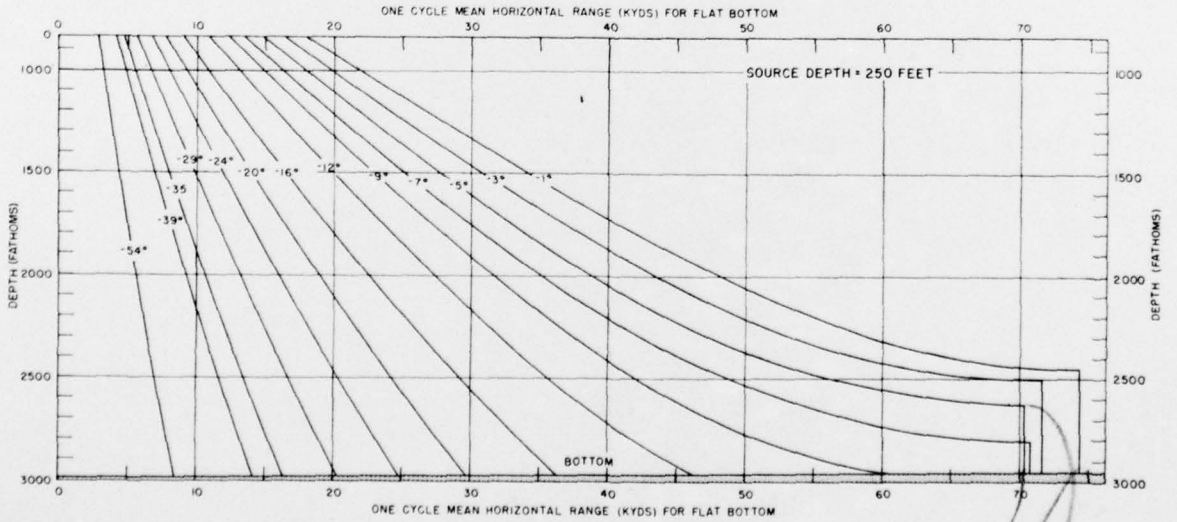


FIGURE 7A MEAN HORIZONTAL RANGE VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR APRIL THROUGH JULY

Zone width

initial Range at surface

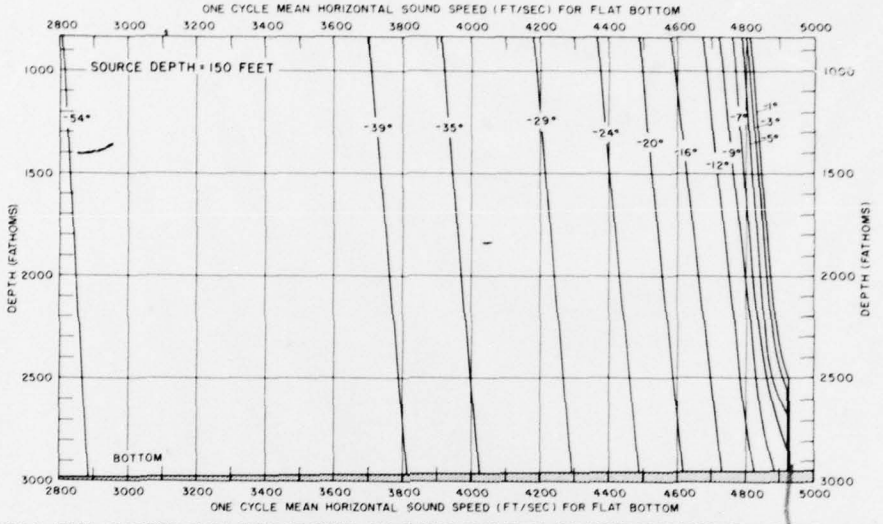


FIGURE 8 MEAN HORIZONTAL SOUND SPEED VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR APRIL THROUGH JULY

mean Horz Speed

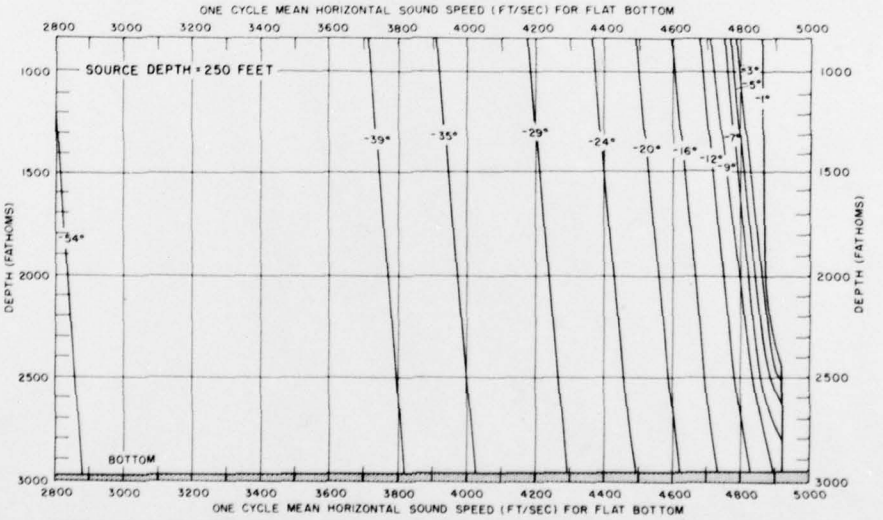


FIGURE 8A MEAN HORIZONTAL SOUND SPEED VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR APRIL THROUGH JULY

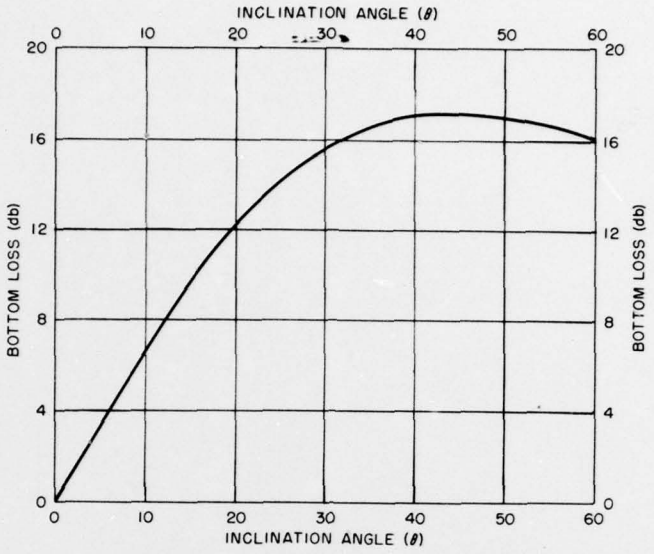
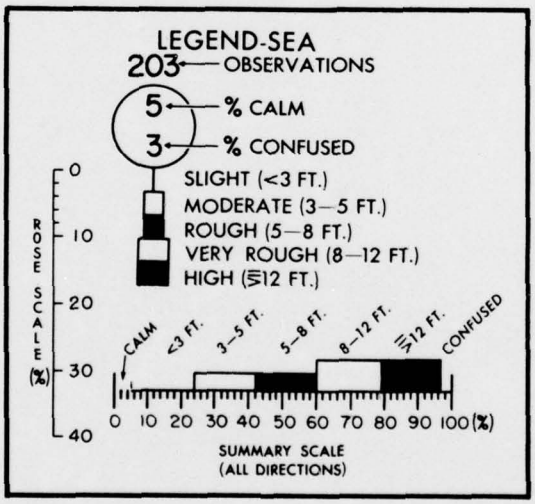


FIGURE 9 NOMINAL BOTTOM LOSS



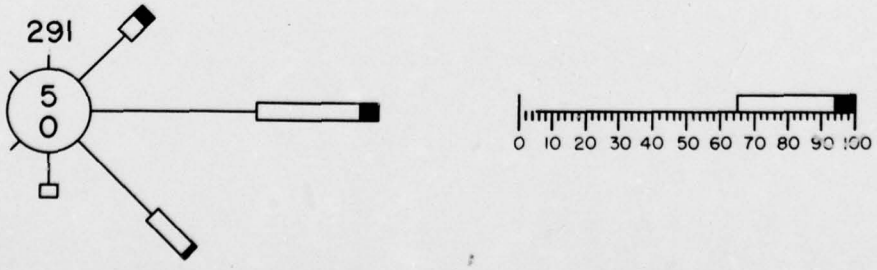


FIGURE 10 SEA STATE ROSE AND HISTOGRAM FOR APRIL THROUGH JUNE

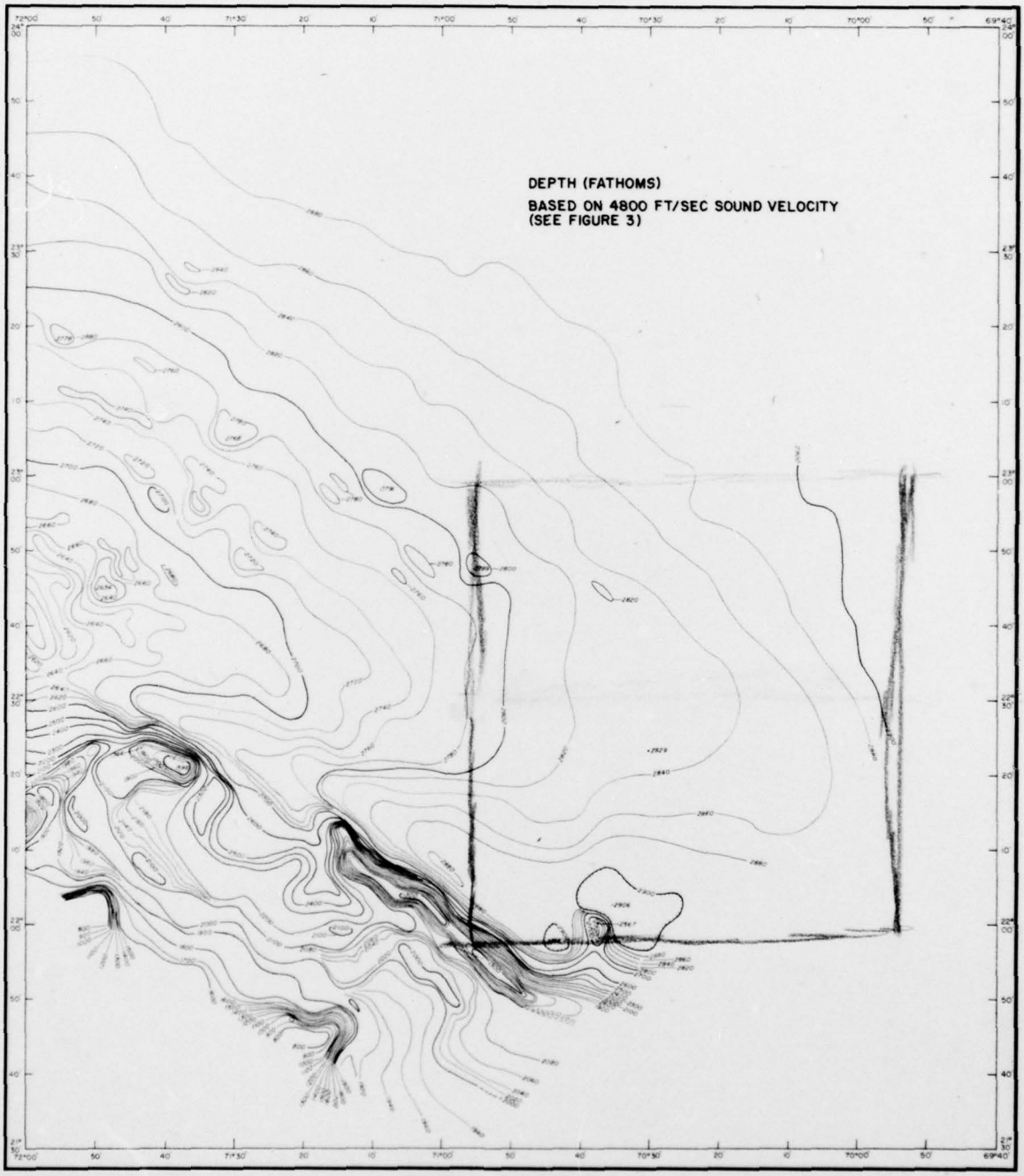


FIGURE 11 BATHYMETRY

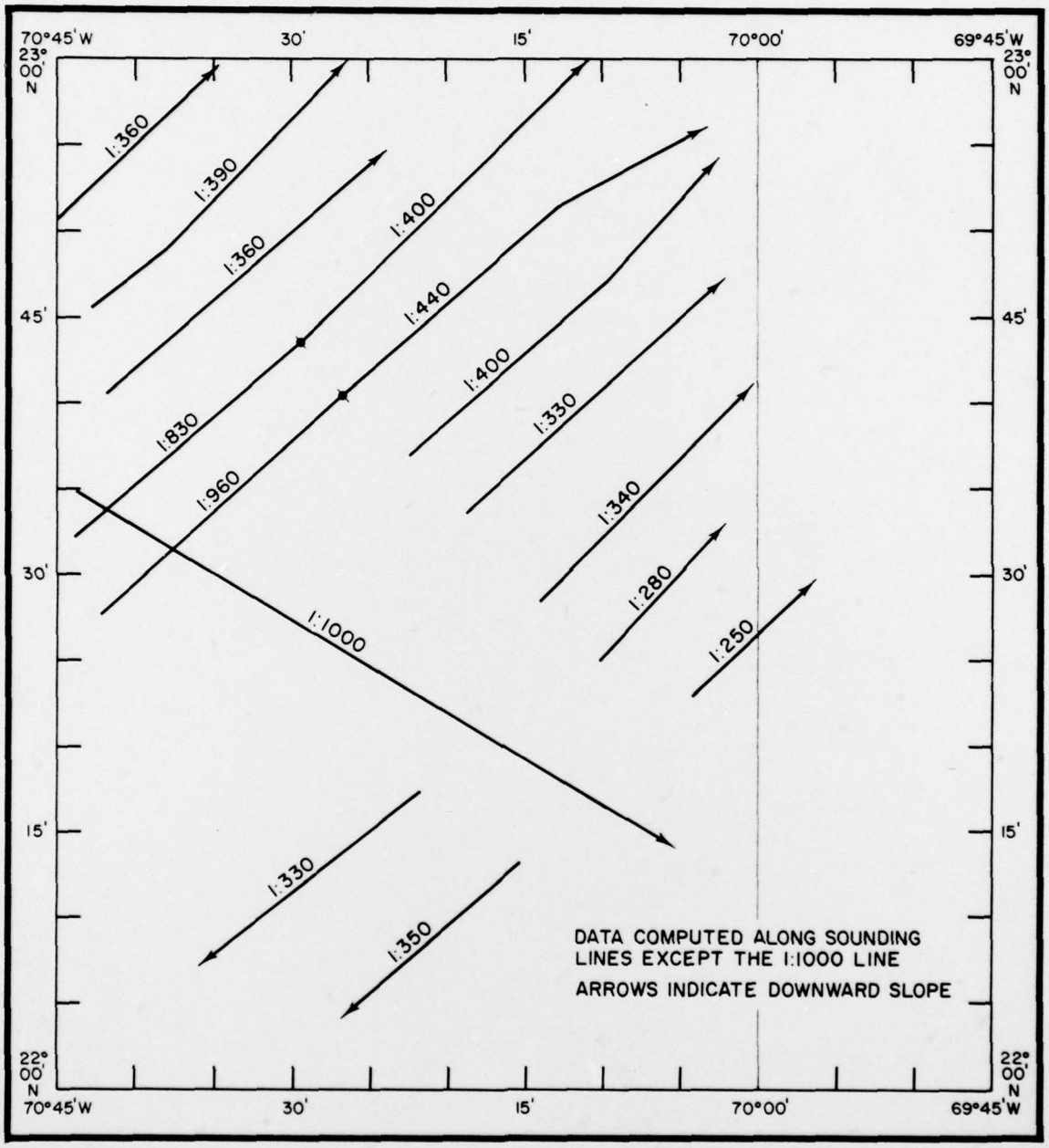


FIGURE 12 BOTTOM SLOPE GRADIENTS

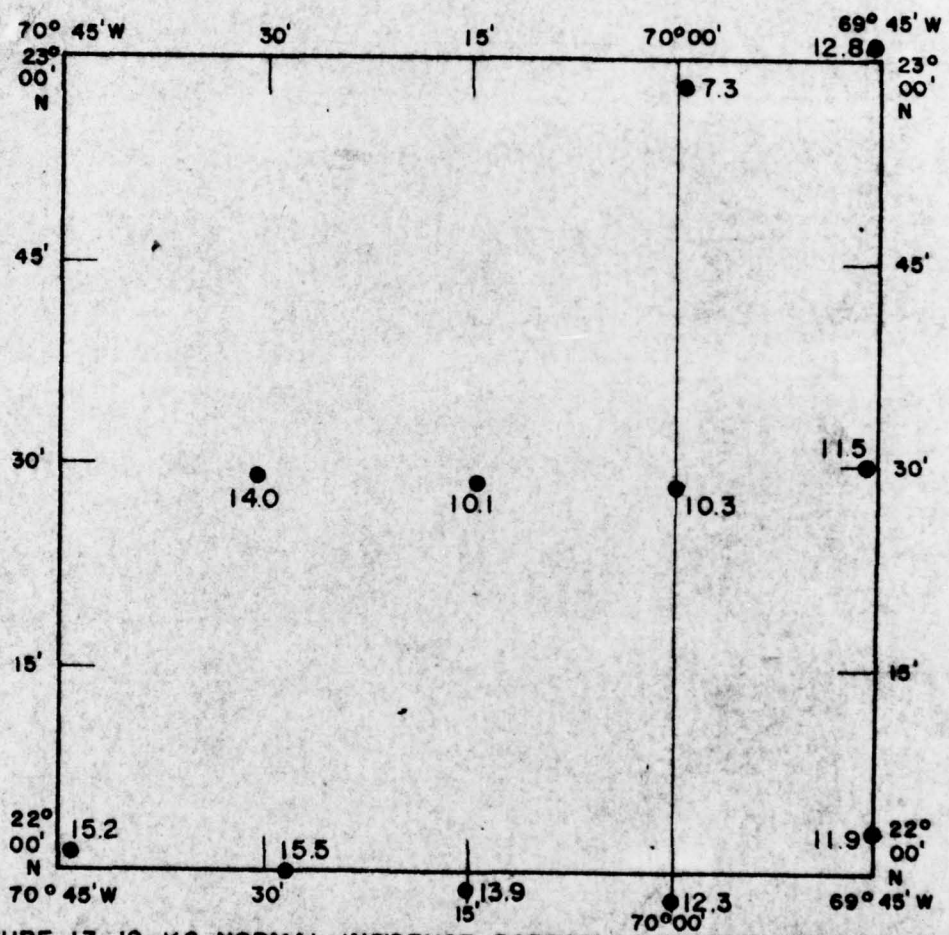


FIGURE 13 12-KC NORMAL INCIDENCE BOTTOM LOSS MEASUREMENTS (db)

AREA "J"

TOPOGRAPHY

Bathymetric data for this area were collected during 2 separate surveys. One survey was centered at 22°31'N, 70°20'W, covered 1,520 square miles, and used LORAC positioning. The second survey was centered at 22°30'N, 70°10'W, covered 2,000 square miles, and used LORAN A for positioning. The second survey was conducted in 1962 by the USS SHELDRAKE but did not include the southeastern portion of the area.

The area is located on the outer edge of a broad ridge. Gradients have a minimum slope of 1:1000 and a maximum of 1:250. Examination of the 12-kc depth records revealed no penetration of the sound rays into the bottom and no evidence of minor irregularities in the bottom topography.

Bottom sediments consist of soft, sticky brown clay with particles less than 0.074 mm in size and containing as much as 15 % calcium carbonate in the form of globigerina tests.

DEEP SCATTERING LAYER

The deep scattering layer (DSL) occurs throughout this area at depths of 250 to 275 fathoms. The intensity of the layer may vary from day to day.

Discontinuous shallow scattering layers (SSL) have been recorded using 14, 18, and 50 kc equipment. These layers, which have been recorded during all seasons, are nonmigratory and rather uniform in intensity.

BIOLOGY

During the period April through July there is probably about 1 whale per 1,000 square miles. The occurrence of porpoises is sporadic and cannot be estimated. The number of schooling fishes in this area is unknown, but the area is seaward of the largest concentration of these fishes.